REMARKS

The Specification has been replace with the new Specification attached hereto. The Abstract and Claims have been amended to correct typographical errors. Claims 1-42 are pending in this application. Claims 20-42 have been added.

Conclusion

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Esther H. Chong (Reg. No. 40,953) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

Dated: July 22, 2005

Respectfully submitted,

By Esther Chong

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Marked up copy of Substitute Specific.

PCT/KR2004/000108
RO/KR 12.03.2004
10/543129
JC14 Rec'd PCT/PTO 22 JUL 2005

DESCRIPTION

METHOD OF MANAGING PLAYBACK SPEED INFORMATION OF A RECORDING MEDIUM, RECORDING MEDIUM WITH PLAYBACK SPEED INFORMATION FOR VIDEO CONTENT RECORDED THEREON, AND REPRODUCING METHOD FOR THE RECORDING MEDIUM

1. Technical Field

The present invention relates to a method of managing playback speed information for reproducing a main A/V data recorded on a high-density recording medium such as a Blu-ray Disc ROM at a playback speed suitable to the recorded A/V data, and a high-density recording medium having such playback speed information.

The present invention relates to a method of reproducing a main A/V data recorded on a high-density recording medium at an appropriate playback speed based on information obtained from such a high-density recording medium.

2. Background Art

The standardization of new high-density rewritable optical discs capable of recording large amounts of high-quality video and audio data has been progressing rapidly and new optical disc related products are expected to be commercially available on the market in the near future. The Blu-ray Disc Rewritable (BD-RE) is one example of these new optical discs.

As shown in Fig. 1, a BD-RE is organized, in the radial direction, into a clamping area, a transition area, and a burst cutting area (BCA), a lead-in area, a data area, and a lead-out area.

The lead-in area is organized into the first guard (Guard 1) area, a permanent information and control data (PIC : Permanent Information & Control data) area, the second guard

(Guard 2) area, an information (Info 2) area, and an optimum power calibration (OPC) area. While, the Guard 1 area and the PIC area are pre-recorded areas, the others of the lead-in area, the data area, and the lead-out area are all rewritable areas.

The PIC area is used to write or store a disc general information that should be kept permanently. The disc general information is encoded through high-frequency modulation and is then written to the track wobble on the disc through bi-phase modulation, as shown in Fig. 2.

According to Fig.2, HFM Grooves are modulated in the radial direction with a rather high bandwidth signal, to create a data channel for replicated information with sufficient capacity and data rate.

In this modulation method a bit with value 0 is represented by a transition at the start of the bit cell and a bit with value 1 is represented by a transition at the start and in the middle of the bit cell. The modulated bits are recorded on the disc by a deviation of the groove from its average centerline as indicated in the FIG.2. The length of each bit cell shall be 36T, where T corresponds to the length of a channel bit in the Rewritable data areas.

In addition to the BD-RE, technical specifications on Blu-ray disc read-only (BD-ROM) have been discussed intensively among major companies. As shown in Fig. 3, a BD-ROM is organized into an inner area, a clamping area, a transition area, an information area, and a rim area. The BD-ROM is characterized in that a data zone within the information area is capable of storing high-quality A/V main data.

For example, the BD-RE is commonly used to write digital TV broadcast stream data, whose transfer rate is about 36Mbps. On the other hand, the BD-ROM is capable of storing A/V stream data of high-quality video contents that requires higher transfer rate, say, 40Mbps or more. Hence, if the transfer rate suitable to the high-quality A/V stream recorded on a BD-ROM is unknown, read-out operation of data from the BD-ROM at

a transfer rate of 36Mbps causes reproduction of the A/V stream to fail.

3. Disclosure of the Invention

It is therefore a primary object of the present invention to provide a method of managing playback speed information recorded on a read-only recording medium that enables to reproduce a video content recorded thereon at a playback speed suitable to the video content.

It is another object of the present invention to provide a recording medium having playback speed information that specifies a playback speed at which real-time video contents recorded thereon can be reproduced successfully.

It is another object of the present invention to provide a method of obtaining a playback speed from a recording medium at which a video content on a recording medium can be reproduced and reproducing the recording medium at the playback speed.

A method of recording playback speed information on a recording medium in accordance with the present invention comprising: recording a video data on the recording medium; and recording playback speed information for the video data ahead of a data area where the video data is recorded.

A recording medium according to the present invention is characterized in that the recording medium includes video data as well as playback speed information thereof that is written ahead of a data area including the video data.

A method of reproducing a recording medium according to the present invention including the steps of: driving the recording medium on which the video data is recorded; obtaining playback speed information for the video data from the recording medium; and reproducing the video data while driving the recording medium at a speed equal to or faster than a speed specified by the playback speed information.

According to the present invention, it is possible to reproduce high-quality A/V contents on the recording medium that require higher transfer rate than a digital TV broadcast

stream.

4. Brief Description of the Drawings

In the drawings:

Fig. 1 shows a schematic diagram of a disc structure of a Blu-ray disc rewritable (BD-RE);

Fig. 2 shows high-frequency modulated grooves formed on a PIC area of a BD-RE;

Fig. 3 shows an area format of a read-only blue-ray disc (BD-ROM);

Fig. 4 illustrates a lead-in zone on which playback speed information is recorded according to the present invention;

Fig. 5 shows a disc information table on a PIC area including playback speed information according to the present invention; and

Fig. 6 shows a schematic diagram of an optical disc reproducing apparatus for reproducing a high-density blue-ray disc according to the present invention.

5. Best Mode for Carrying Out the Invention

In order that the present invention may be fully understood, preferred embodiments thereof will now be described with reference to the accompanying drawings.

As described before with reference to Fig. 3, a BD-ROM according to the present invention is organized into an inner area, a clamping area, a transition area, an information area, and a rim area.

Disc information includes, among other things, disc information (DI) identifier, DI format, and disc size/version, and is recorded in a permanent information and control data (PIC) area in the information area. Data is recorded on the BD-ROM by making pre-pits on the surface of the BD-ROM.

A data zone in the information area is used to write real-time high-quality video data such as movie contents that requires a ~~playback speed (~~transfer rate~~)~~ of 40Mbps or more. As shown in Fig.4, the disc information includes, besides general information including a disc information identifier,

playback speed ~~(transfer rate)~~ information of the video data.

For example, Fig 5 illustrates DI(Disc Information), which includes "the disc information identifier" representing the characters "DI" at zero byte, "DI format" identifying the contents of the DI unit at 2nd byte, "Number of DI frames in each DI block" specifying the number of DI units N in each DI Block ($1 \leq N \leq 32$) at 4th byte, "DI unit sequence number in DI block" specifying the sequential DI unit number within the DI block at 5th byte, "Number of DI bytes in use in this DI unit" indicating the number of bytes in use in the actual DI unit at 6th byte, "Disc type identifier" representing the characters "BDO" at 8th to 10th bytes, "Disc size/version" specifying the disc size and disc version number at 11th byte, "disc structure" specifying the number of recorded layers and the type of the recoded layers at 12th byte, "channel bit length" specifying the main data channel bit length at 13th byte, "BCA descriptor" indicating the presence of a BCA-code on this disc at 16th byte, "maximum transfer rate of application" specifying the maximum transfer rate needed by the application and represented by Mbit/s, and "data zone allocation" specifying the first and the last address unit numbers of the data zone of the related layer. In addition to that, according to this invention, the playback speed ~~(transfer rate)~~ information is four bytes long and is recorded in a reserved area within the disc information table, at the 32-th to 35-th bytes, as shown in Fig. 5. The playback speed ~~(transfer rate)~~ information also may be recorded with "maximum transfer rate information" recorded in the field of 'maximum transfer rate of application' that is one byte long.

Meanwhile, t~~T~~he playback speed ~~(transfer rate)~~ information may be recorded as a ratio thereof to a transfer rate of digital TV broadcast stream of 36Mbps (hereinafter this transfer rate is denoted by 1X). For example, if the transfer rate of a video content from the BD-ROM is higher than 40Mbps, and the ratio is equal to k, where k is an integer equal to or greater than 1, the playback speed ~~(transfer rate)~~ information becomes greater than 40/36 x k

(approximately 1.12k). If the transfer rate of the video content is 40Mpbs, then 1.12k is recorded as the playback speed ~~(transfer rate)~~ information.

As shown in a schematic diagram of Fig. 6, an optical disc reproducing apparatus according to the present invention includes, among other things, an optical pickup 11 for picking up signals from am optical disc; a video disc play (VDP) system 12 for performing signal processing and servo-control operations; and a D/A converter 13.

Once a BD-ROM is loaded on which a video content has been recorded together with playback speed ~~(transfer rate)~~ information thereof, the VDP system 12 starts to rotate the BD-ROM and then controls the optical pickup 11 so as to locate the PIC area on the BD-ROM and to read the disc information from the PIC area. At the time of initial reproduction, the BD-ROM is reproduced at a basic speed of 1X or an allowable maximum speed at which data can be read out from the PIC area. If it is determined that data on the PIC area is encrypted, the BD-ROM should be rotated at the allowable maximum speed.

Then, the playback speed ~~(transfer rate)~~ information is obtained from one byte at the 17-th byte or four bytes at the 32-th byte of the disc information.

For example, if ~~the playback speed (~~transfer rate~~)~~ information is identified as 40Mbps, that is, 1.12k, the VDP system 12 drives the BD-ROM at a speed of 1.12k times 1X (hereinafter is denoted by 1.12kX) or more than 1.12kX, for example 1.5kX, and moves the optical pickup 11 to the data zone so that video and/or audio data is read out and then decoded into the output. The transfer rate information indicating 40Mbps may be recorded as one byte long in the field of "maximum transfer rate of application". If the optical disc reproducing apparatus of Fig. 6 can operate at multiple playback speed ~~(transfer rate)~~ levels, e.g., N_1X, N_2X, N_3X,…,N_IX, where N_1, N_2, N_3 ,…,N_I are all integers, and if none of the multiple playback speed ~~(transfer rate)~~ levels are equal to the ~~playback speed (~~transfer rate~~)~~, the video content is reproduced at one of multiple playback speed ~~(transfer~~

~~rate)~~ levels that is the closest one faster than the ~~playback speed (~~transfer rate~~)~~. For example, if the playback speed ~~(transfer rate)~~ is 1.12k, which falls between N_{I-2} and N_{I-1} ($N_{I-2} < N_{I-1}$), the VDP system 12 drives the BD-ROM at a speed of $N_{I-1}X$.

While the invention has been disclosed with respect to a limited number of embodiments, those skilled in the art, having the benefit of this disclosure, will appreciated numerous modifications and variations therefrom. It is intended that all such modifications and variations fall within the spirit and scope of the invention.